

Application No. 10/551,585
Docket No. 03809-P03873US00

Art Unit 3768
Examiner Nguyen, H.

REMARKS

Claims 57 – 110 are pending in the application, of which claims 80 – 110 stand withdrawn, claim 79 stands objected-to, and claims 57 – 79 stand rejected. Claim 79 has been canceled above.

REJECTIONS UNDER 35 U.S.C. 112

Claim 79 is objected to “because claim 57 already claims the same method steps of reconstructing nuclear Magnetic Resonance images.” Claim 79 has been canceled above rendering the rejection moot.

REJECTIONS UNDER 35 U.S.C. 103(a)

Claims 57 – 64 and 79 stand rejected under 35 U.S.C. 103 as “being unpatentable over Dong et al. (Rectification of distortion in MRI for stereotaxy (applicant submitted reference in IDS)) and in view of Haacke EM et al. (Magnetic Resonance Imaging (applicant submitted reference in IDS)).” Applicant respectfully disagrees for the following reasons.

Dong et al

Dong et al discusses techniques for correcting for geometrical distortion in MRI images, for the purpose of improving the suitability of MRI for stereotaxy (see abstract of Dong et al). Thus, the patient’s skull is rigidly attached to a frame preventing motion of the patient (see page 185 of Dong et al). As discussed in the abstract of Dong et al, the correction techniques are based on the acquisition of an additional image of the patient utilizing a reversed readout gradient, and then averaging this with the initial image (see the abstract and equation 10 of Dong et al). In fact the image correction technique used by Dong et al is similar to that discussed on page 6-7 of the present application.

As the Examiner says in the Official Action; present claim 57 differs from Dong et al in the requirement that second data items of the second set are acquired before acquisition of the first set is complete.

Haacke et al

Haacke et al discusses techniques for dealing with system instabilities during MRI imaging. Haacke et al teaches that, if possible, the gradient structures in each acquisition should be identical (see paragraph 1 of Haacke et al). In this way, any artefacts that occur from motion

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will then be essentially the same for each image. The artefacts are then removed by subtracting the images (see interleaving scans paragraph of Haacke et al).

Present claim 57 differs from Haacke et al in the requirement that the second value of the predetermined spatial gradient differs from the first value thereof, and that the second set of image data items are acquired using the second value of the predetermined spatial gradient which differs from the first value thereof.

Point 4 of Official Action

In point 4 of the Official Action, the Examiner asserts that it would have been obvious for the skilled person to modify Dong et al in view of Haacke et al and arrive at the features of present claim 57. Respectfully, the Examiner is incorrect.

The present invention solves a problem of correcting for geometric distortions arising in MRI images, due to distortions of the magnetic field, for images that vary during or between successive image acquisition sequences due to movement of the subject.

A skilled person would not attempt to modify Dong et al to solve this problem in the manner suggested by present claim 57, as this problem is not present in the technique discussed in Dong et al. In Dong et al the patient is secured to a rigid frame which is itself rigidly secured to a scanner table. It is confirmed (see page 185, near bottom) that with such an arrangement there is no motion of the patient between consecutive image acquisition sequences. Therefore, the skilled person would see no purpose or benefit in interleaving the image scans.

However, even if, purely for the sake of argument, the skilled person, starting from Dong et al, were motivated to develop an alternative solution to the problem of subject motion, he would not obviously or straightforwardly apply selected features disclosed in Haacke et al to the approach of Dong et al in order to arrive at the present invention. Firstly, Haacke et al only suggests that interleaving of MRI scans “is an ideal way to collect data that needs to be subtracted”. In contrast, in the technique of Dong et al, the two images taken with opposite readout gradients are not subtracted. Instead, as shown by equation (10) of Dong et al, a position in a rectified image is found by averaging positions in the first and second images. The rectified image is then produced by equation (11). Directly subtracting the two images in Dong et al would not result in an image which is corrected for geometrical distortion. Thus in this important respect the teaching of Haacke et al is incompatible with the technique of Dong et al.

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Furthermore, Haacke et al teaches that the gradient structures in each acquisition should be identical if possible. In contrast, the correction technique of Dong et al requires a reversed readout gradient for the second image, and would not work if the readout gradients for the first and second images were identical. Haacke et al further says that when it is not possible to have identical gradients, any additional gradient structures should be oscillatory and fast. Such gradient structures are clearly unsuitable for the correction technique of Dong et al.

Therefore, due to the technical incompatibility of the disclosures of Dong et al and Haacke et al, a skilled person could not obviously combine the features of the two disclosures to arrive at present claim 57. Instead, considerable inventiveness would be required on the part of the skilled person to decide which features of Haacke et al could be applied to Dong et al.

Accordingly, claim 57 is inventive with respect to Dong et al in view of Haacke et al.

Points 5-11 of the Official Action

The objections in points 5-11 of the official action relate to dependent claims, and allowable for at least the reason that such claims depend from allowable independent claim 57.

For at least the above reasons, Applicant respectfully submits that all pending claims are allowable, and accordingly requests the withdrawal of all pending rejections.

Respectfully submitted,

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